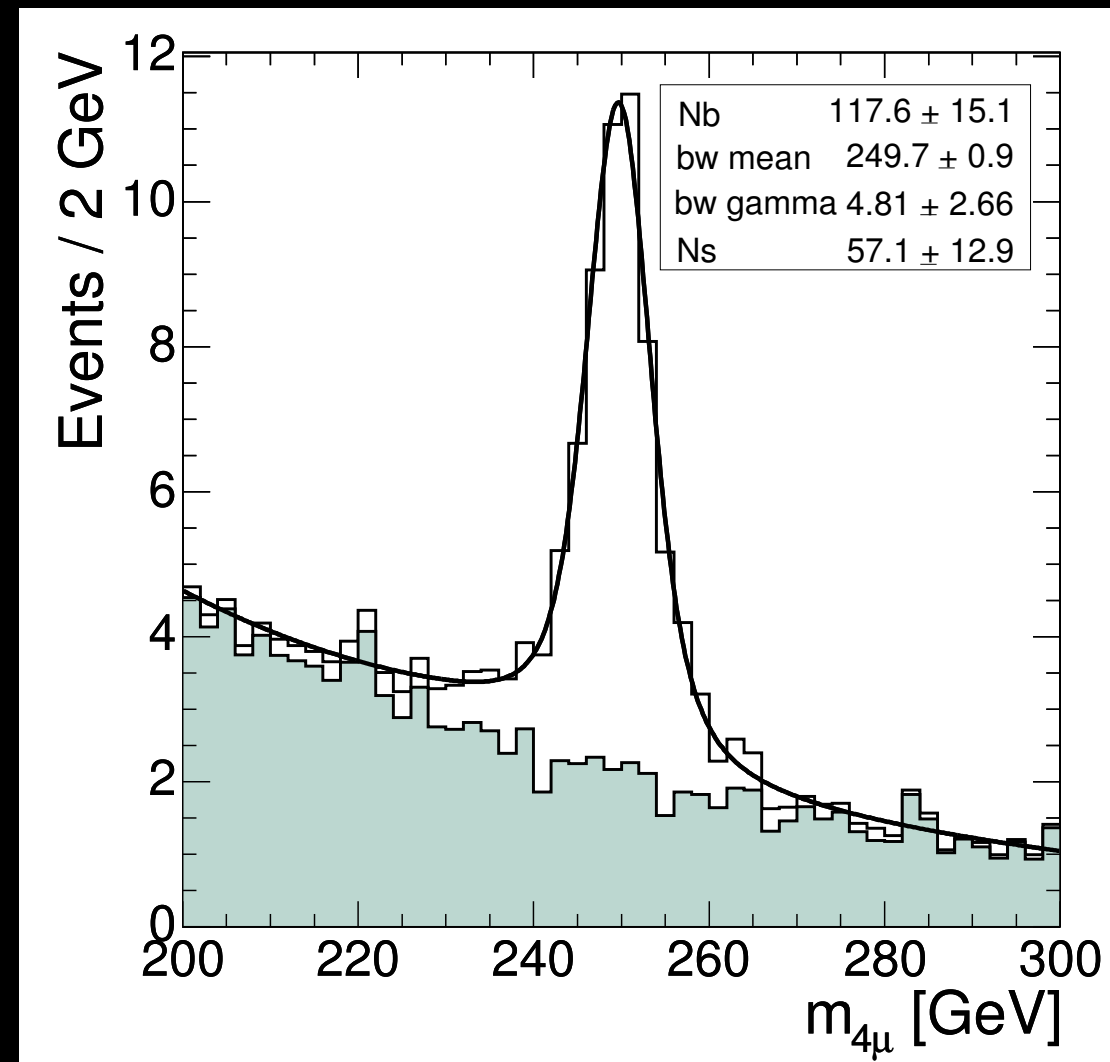
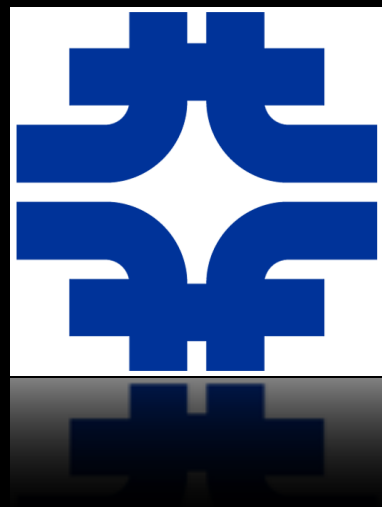


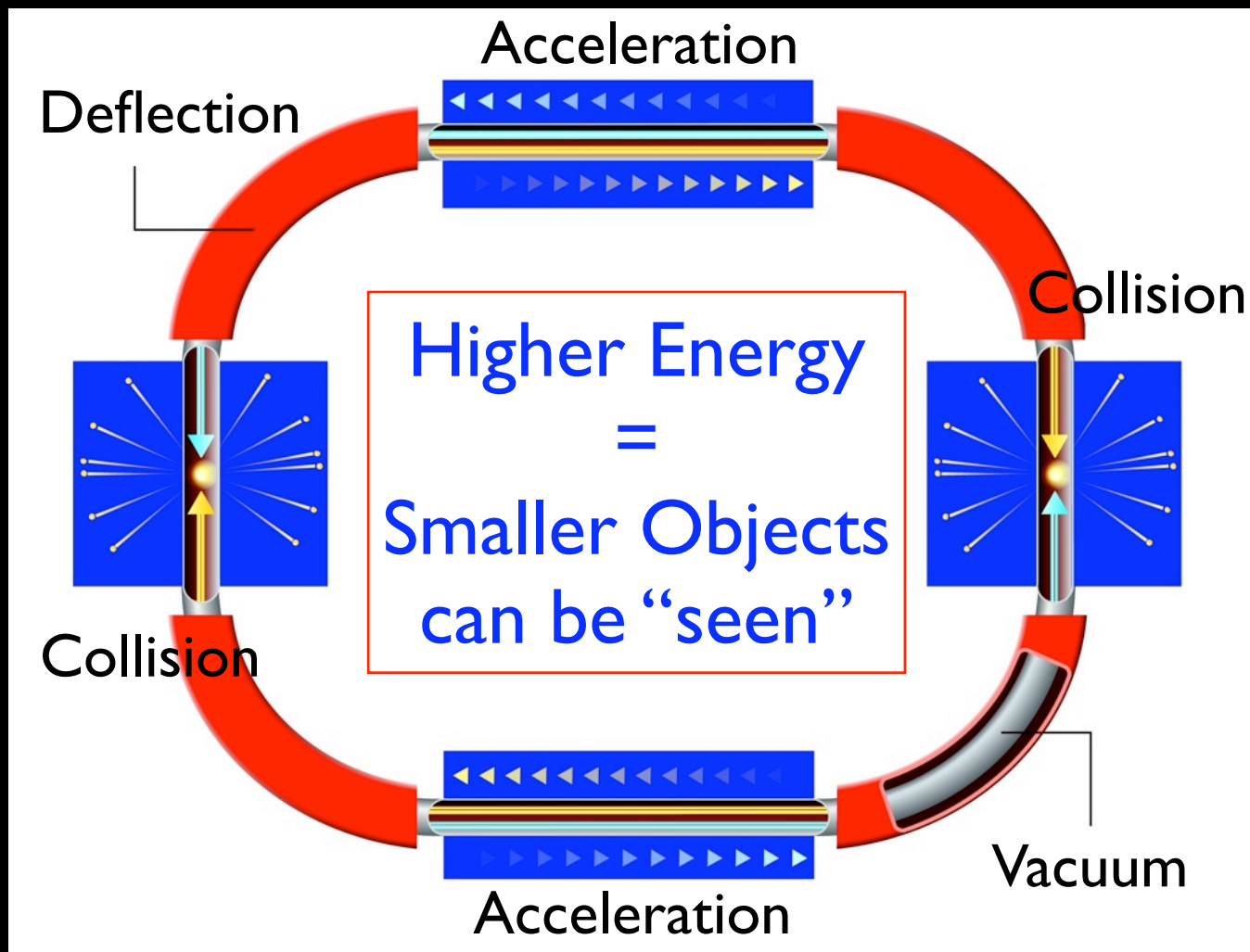
# CMS Global Analysis



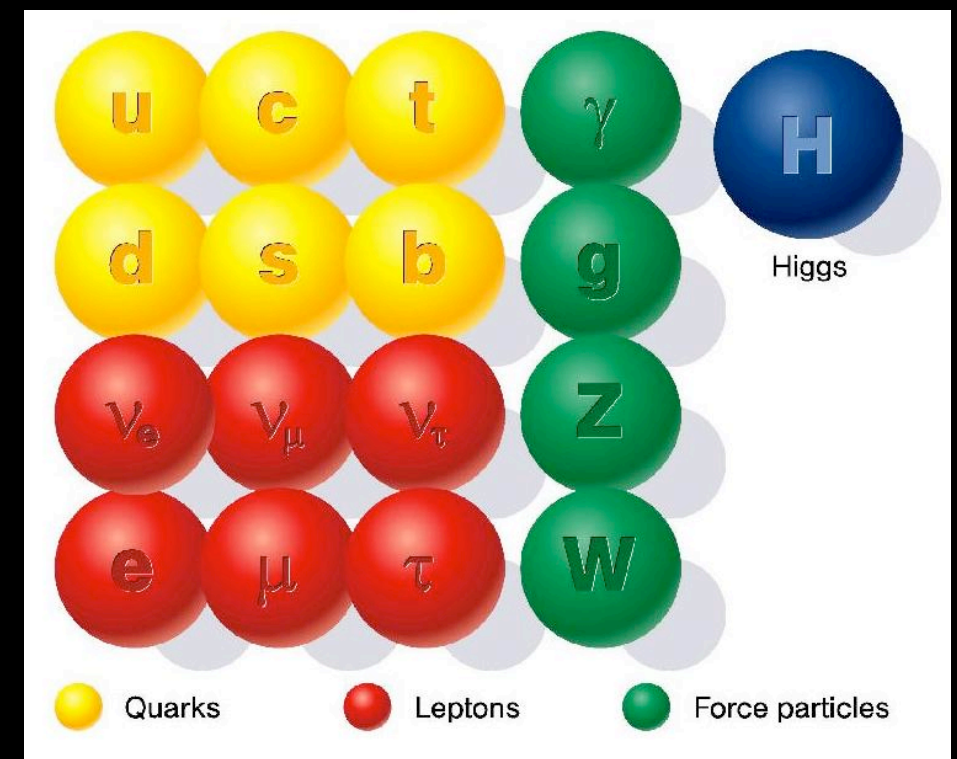
Oliver Gutsche - Fermi National Accelerator Laboratory



# Particle Physics



- Describe structure of matter using mathematical concepts: **Standard Model**
- **Higgs**: concept to describe mass of particles
- not discovered yet  $\Rightarrow$  LHC

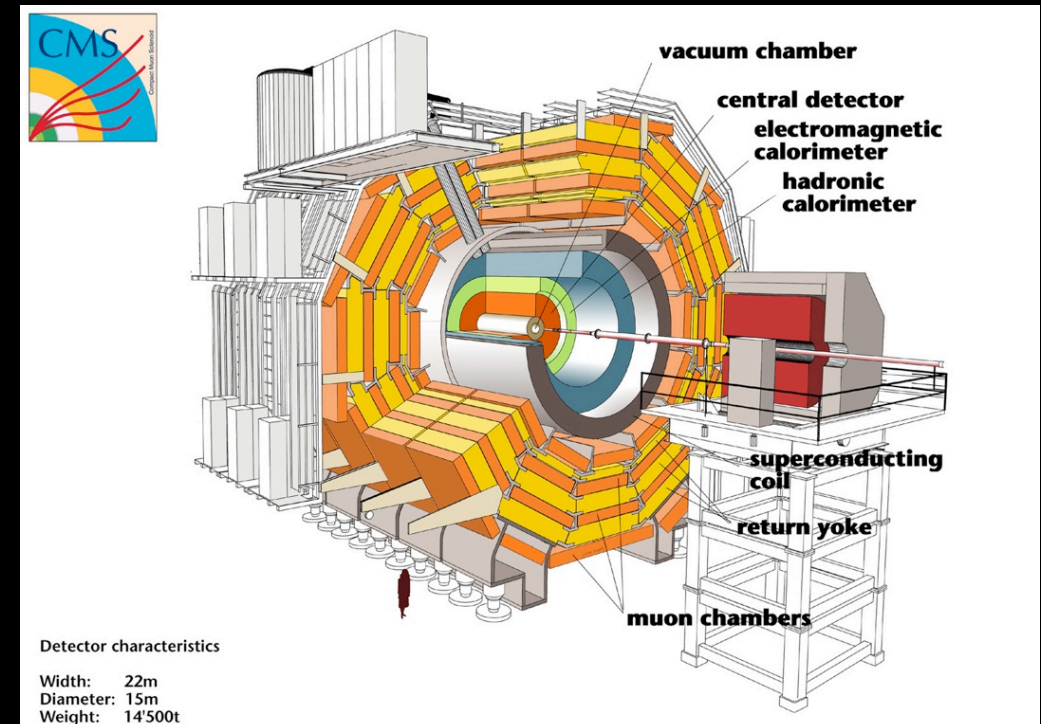


- Investigate structure of matter by
  - Colliding elementary particles
  - Detecting collision products



# LHC and CMS

- **Large Hadron Collider** at CERN, Geneva, Switzerland
  - Proton-Proton collisions
  - Beam energy: 7 Terra Electron Volts
    - ➔ 40 t truck hitting wall at 90 MPH
- Circumference: 27 km



Detector characteristics

Width: 22m  
Diameter: 15m  
Weight: 14'500t

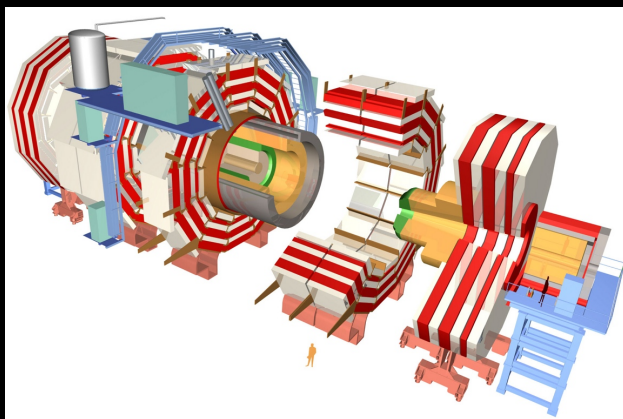
MASS: 14'200t  
DIMENSIONS: 12m  
MASS: 55m

- **Compact Muon Solenoid:**
  - One of 4 particle collision detectors at the LHC
  - Width: 22m, Diameter: 15m
  - Weight: 14,500 t
  - International collaboration of **2000** physicist

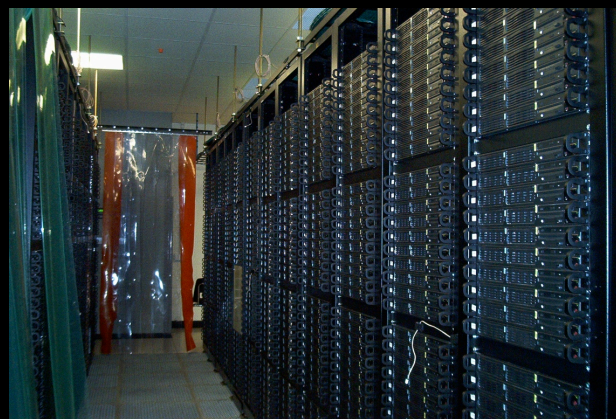


# CMS Data Analysis

- Collisions occur at **40 MHz**
- Trigger reduces to **150 Hz**
- Output contains all recorded detector signals and derived information, called “Event”
- Events are analyzed separately  
(**High degree of parallelization**)
- Estimated number of recorded and simulated events
  - 2007: **300 million**
  - 2008: **3 billion**
- Peta-scale data volumes
  - 2007: **640 TeraByte**
  - 2008: **6400 TeraByte**



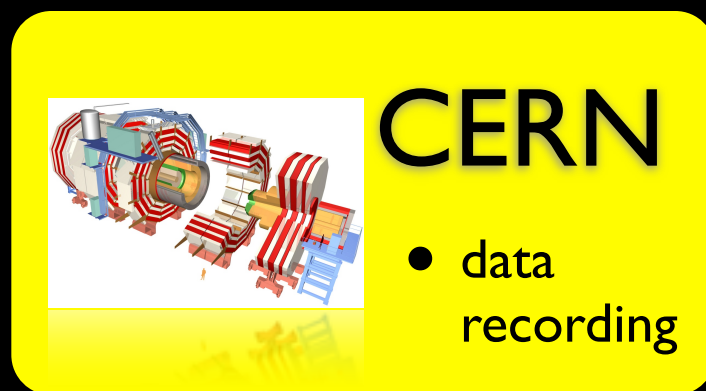
Data recording:  
**1.8 MB/evt.**



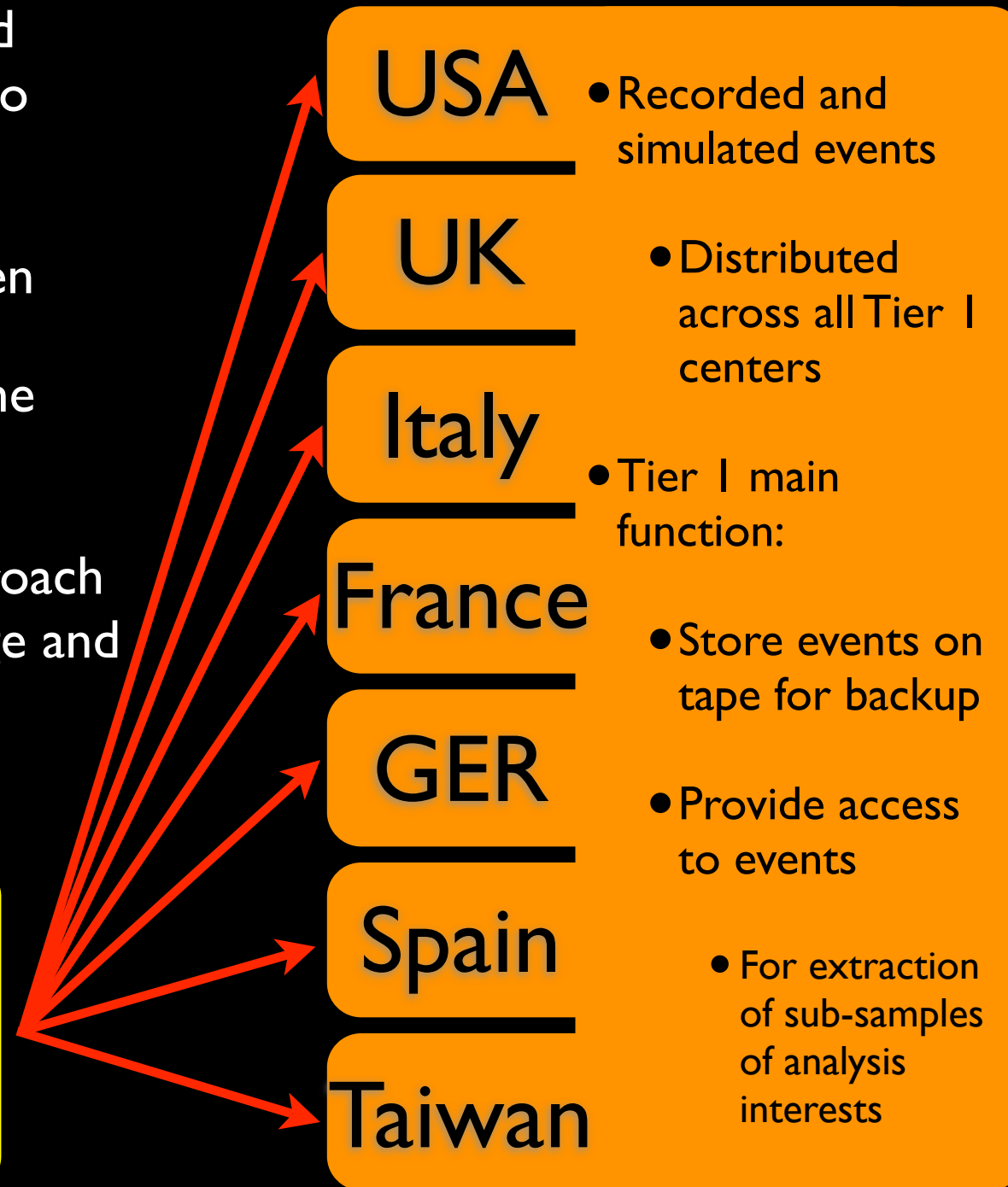
Simulation:  
**2.5 MB/evt.**

# CMS Tier Structure

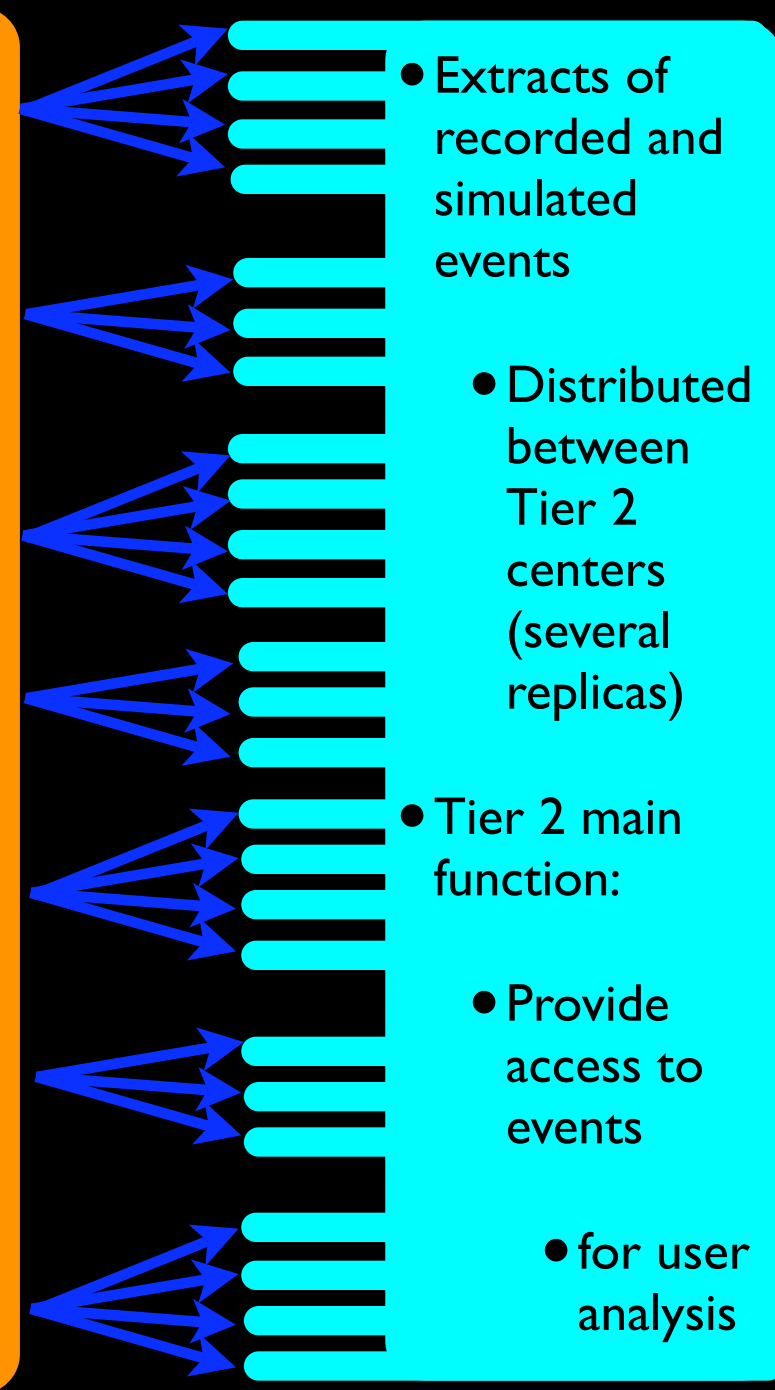
- 2000 physicists scattered around the globe want to analyze CMS data
- Analysis is location driven
  - “Job is sent where the data is stored.”
- CMS follows GRID approach to distribute data storage and processing world-wide



1 Tier 0



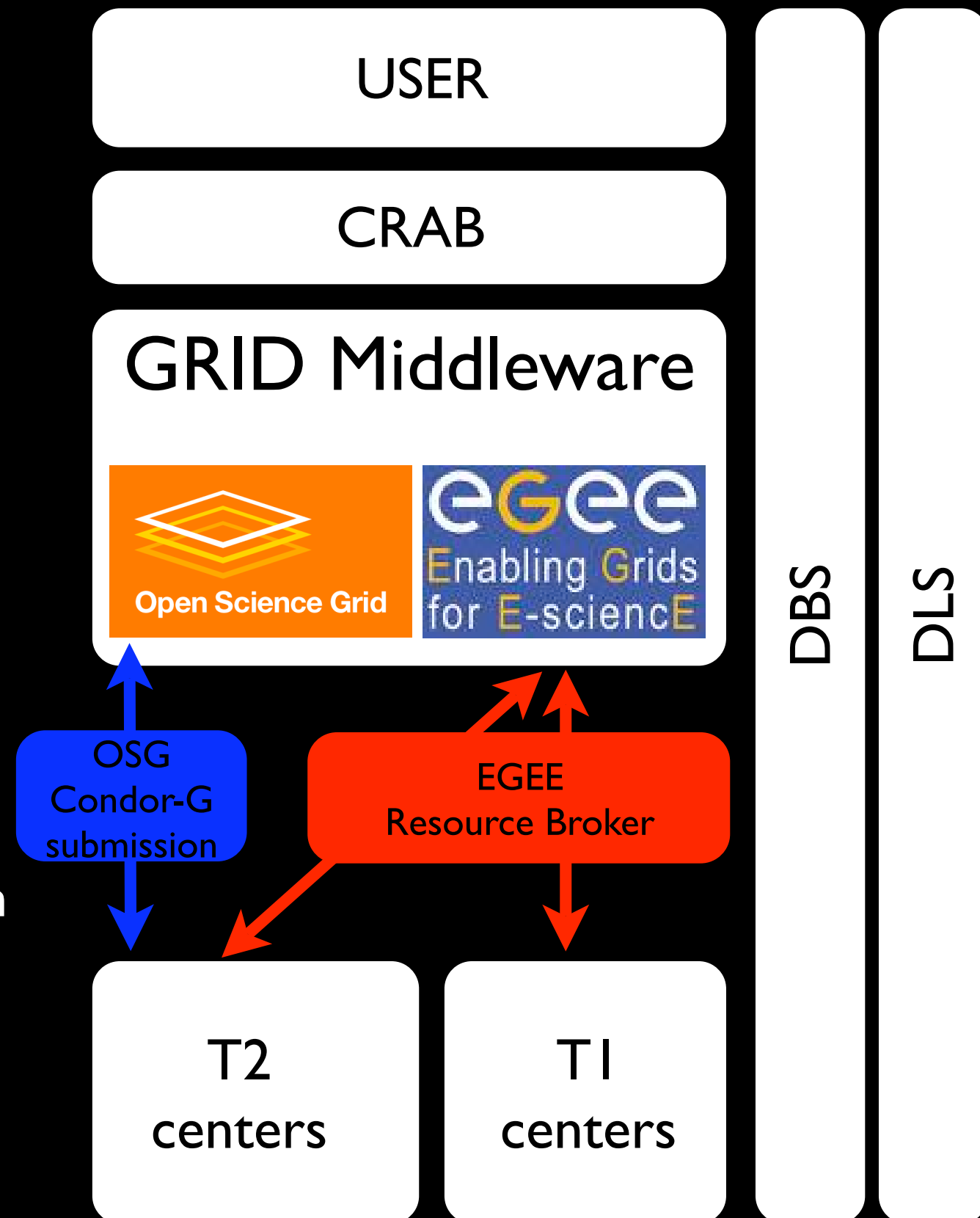
7 Tier 1



~25 Tier 2

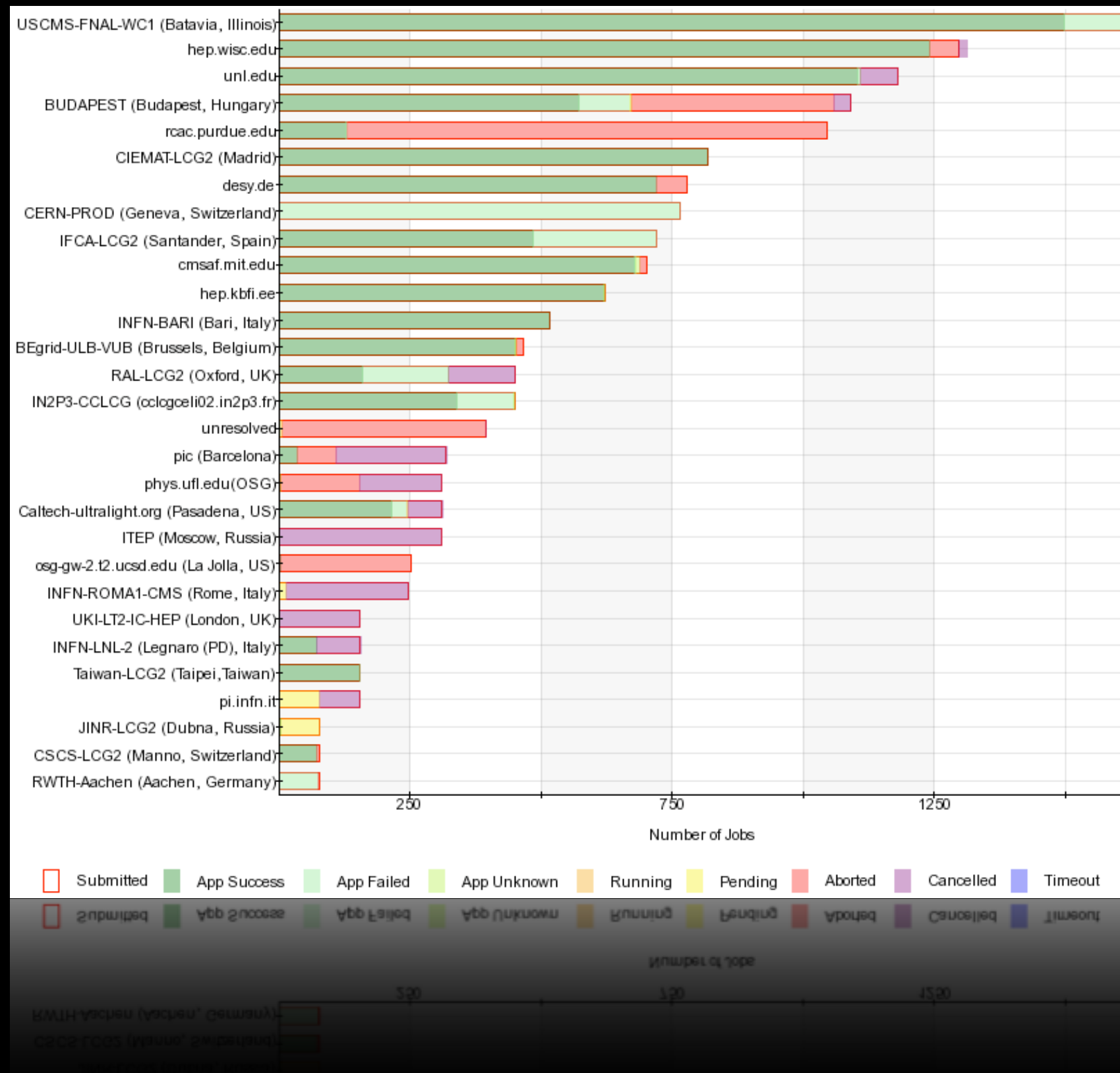
# Global Data Access

- Equal fair share access for all CMS users
- User tool: **CMS Remote Analysis Builder**
- Global Data Discovery Services:
  - **Data Bookkeeping Service**
  - **Dataset Location Service**
- GRID submission:
  - EGEE resource broker submission to all centers
  - OSG Condor-G submission to OSG T2



# Infrastructure Performance

- Automated test of analysis infrastructure
- Goal:
  - 12,500 analysis jobs per day
- Reached and sustained over days
- Shown example day: 15,529 jobs



# Summary & Outlook

- CMS Global Analysis provides all CMS users with access to **peta-scale** data volumes
  - distributed world-wide
  - accessible via GRID structure
- Infrastructure achieves current performance goals

## Simulated Signal

